SCIENCE & EDUCATION
Impact
Benefits from USDA/Land-Grant Partnership

# The Power of Progress

## Bioenergy and biomaterials from ag products could fuel bright future.

***Think of trees and crops as storage cells for solar energy, green batteries that produce potential energy that's later released through burning or fermentation. Biofuels and biomaterials are shorthand for developing fuels, feedstocks and substances from America's renewable crop and forest resources.***

***The need for more dependable and stable energy sources is obvious. In 1998, America consumed 30 percent more energy than it produced. The Department of Energy estimates cleaner-burning biofuels could generate as much as $20 billion a year in new income for American farmers and rural economies and reduce annual greenhouse gas emissions by up to 100 million tons.***

***More effective use of ethanol and soy diesel would help. Fuels are just the start. Research by the USDA and Land-Grant universities is adding a new generation of plant-based adhesives, waxes, plastics and building materials to ethanol, soy ink and other established biomaterials.***

### Payoff

- **High-octane cotton.** A growing cotton industry in Virginia poses a problem amidst the prosperity. Cotton gin waste typically gets plowed back into the soil, an economical disposal system, but one that could create pest and disease problems for future cotton crops. **Virginia Tech** scientists have demonstrated in the laboratory that cotton gin waste is a suitable source for fuel ethanol. Successful development could convert existing gin waste into 680,000 gallons of ethanol each year and could create 100 new jobs in southeast Virginia to support the process. Large-scale testing is under way.

- **Harnessing natural horsepower.** Researchers in **Florida** genetically engineered bacteria to convert the sugars in rice hulls, sugarcane residue and wood waste into ethanol. The technology is the basis for a new "bio-refinery" that goes online in Louisiana in 2002. **Kentucky** researchers developed bacteria that speed the conversion of wood and plant fiber into ethanol and other value-added chemicals. **Mississippi** scientists are working to improve cottonwood trees to develop fast-growing

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sources of cellulose for fuel ethanol production.

- **Pulling the wool over.** Surplus wool from Vermont sheep may hold the answer to keeping hillside soils in place. **Vermont** Extension specialists have experimented with using low-grade wool "blankets" to stabilize highly erodible slopes. Wool is a low-cost biodegradable material that holds moisture and soil in place and allows vegetation to flourish, adding plant nutrients as it breaks down. Sheep producers also get a new market for their product.

- **Waste-not wrapping.** Plant starches and other natural compounds are the basis for edible films that can be used as biodegradable food packaging. **Arkansas** researchers also have found that edible films can have anti-microbial properties that protect food from threats like *Listeria.*

- **Board shift.** A new process pioneered by **Iowa State** researchers could make better use of cattle manure. The animal-produced fiber can be mixed with soybean-based adhesives to produce fiberboard suitable for furniture, doors and home construction. Fiberboard production supplies a $1.2 billion market.

- **Industrial plants.** Research at **Purdue** uncovered a gene that allows plants to safely produce and store the chemical building blocks for plastics. Plant-based monomers, the individual molecules that combine to create polymers, may have more applications than petroleum-derived plastics. Scientists believe corn and soybeans could help develop plastics with never-before-seen properties for synthetic heart valves or jet aircraft parts.

- **Flimsy profits.** Americans use 1 billion pounds of petroleum-based plastic sheets for transparent and lightweight packaging each year. **Minnesota** scientists working to bioengineer plastic films from agricultural materials found that blends of 60 percent starch can produce films as thin as 0.3 millimeters. Plant-based plastics are biodegradable and could divert a significant amount of the waste from landfills.

- **Resourceful rice.** Industrial silicates come from sand that's melted in huge furnaces and dissolved in water with alkaline salts, an energy-expensive process. **Arkansas** scientists have found a way to unlock the silicates in rice hull ash, a byproduct of rice processing. The process has yielded industrial adsorbents and silicate-based plastic films and has shown potential for insulation and lightweight ceramics.

- **A can of canola oil.** A canola-based motor oil is equally effective but creates fewer pollutants than its petroleum counterpart. **Colorado State** researchers and an industry cooperator developed the product to give growers an additional market, but the oil also is easier to recycle or dispose of than conventional motor oils. A Michigan-based farm cooperative is commercializing the product.

- **Road worthy.** The Midwest boasts a different kind of rust belt, thanks to the salt most highway departments use to keep icy roads navigable in the winter. **South Dakota State** researchers have developed an environmentally and car-friendly road de-icer made from corn byproducts and lime. The biodegradable product costs a little more, but spares roadside plants and car bodies the harm caused by its more corrosive counterpart.

**Cooperative State Research, Education, and Extension Service**
United States Department of Agriculture

Cooperative State Research, Education, and Extension Service in cooperation with the Extension Committee on Organization and Policy, the Experiment Station Committee on Organization and Policy, the Academic Programs Committee on Organization and Policy, the International Programs Committee on Organization and Policy, and the Louisiana State University Agricultural Center.



April 2001